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ABSTRACT

IBM LinkWay is an example of a hypertext and hypermedia authoring system. This paper summarizes a workshop presentation that demonstrates how to create a mathematics tutorial using LinkWay. An introduction discusses the guidelines for the tutorial. The guidelines consider the presentation of questions, help features for the students, feedback, reference location for students, and other pedagogical aspects of the tutorial. The following section defines terminology related to hypertext and hypermedia. The remainder of the paper guides the reader through the development of the fifth question of a five-question tutorial. The multiple choice question is presented together with potential feedback information and hints for the different responses. The reader is then taken through the following steps to prepare the question for the tutorial: (1) starting up of LinkWay; (2) creating of a new folder; (3) creating related pictures; (4) creating action spot buttons; (5) creating pages and typing responses; (6) cutting, pasting, and editing an object; and (7) finishing the tutorial. (MDH)

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USE OF IBM LINKWAY FOR

DEVELOPING TUTORIALS

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Abstract: The presenters discuss the plan and design of a mathematics tutorial and its implementation using IBM LinkWay. LinkWay is a hypertext and hypermedia authoring system that is easy to use. The presenters demonstrate how to create features like unlimited branching, ease of navigation in the tutorial, and prescriptive analysis of performance.

Background: This is a presentation of a workshop conducted by the authors at the Seventeenth Annual Conference of American Mathematical Association of Two Year Colleges (AMATYC) held at Seattle, Washington, in November 1991.

The participants were given a 3.5" disk with four of the five questions of the tutorial already completed, and the first question was to be done in the workshop. A subdirectory "Sample" contained the complete tutorial. You may obtain this disk from the authors by sending a blank 3.5" disk to the first College Address on the title of the paper. To run the completed version in Sample subdirectory, just access the subdirectory and enter "GO". To develop the quesion given in the presentation, you will need IBM LinkWay installed on your hard drive. For more information and the source code of the programs used in the tutorial, you may refer to a paper titled "Hypertext and Its Use in Developing Tutorials" which will appear in the Journal of Educational Multimedia and Hypermedia."

USE OF IBM LINKWAY FOR DEVELOPING TUTORIALS

Introduction

Last year we planned to develop tutorials to accompany the textbook, Prealgebra, written by Joshua Berenbom and myself and published by Harcourt Brace and Jovanovich, Inc. First of all there are padagogical aspects of the tutorial like designing multiple choice tests taking into account students' mistakes due to misconceptions or lack of skills, and providing appropriate explanation for each mistake. In addition we wanted to evaluate student's performance and prescribe a section from the text for reference for each question missed at the first attempt. Format of presentation is also an important part of the software. Following are the guidelines developed with the help of the HBJ software editor.

1. Main menu with point-and-shoot feature
2. Screen portions delineated by color schemes with boxes
3. Escape routines - Ability to exit the current routine, back to the original menu, at any time
4. Help - context sensitive help accessible by pressing F1 key.
5. Point-and-shoot feature throughout the tutorial in making choices
6. Self pacing
7. Immediate appropriate feedback for each response of the user. Total score goes up when the question is answered correctly at the first attempt. Keep track of Question that is missed at the first attempt.
8. Two hints per question. No points lost for using a hint.
9. Reference to the appropriate section in the textbook
10. Ease of navigation - ability to move back and forth in the tutorial, or quitting at any point.
11. Diagnosis and evaluation
12. Prescription

We were in search of a simple authoring tool which has the capability to accomplish these tasks. About that time there was an IBM conference for intoducing different authoring tools like Toolbook, Quest, Podium (Presentation Overlay Display for Interactive Uses of Media), AVC (Audio Visual Connections), and LinkWay. We found that LinkWay was a perfect answer to our needs. LinkWay is based on hypetext and hypermedia.

Hypertext and Hypermedia

Hypertext is a nonsequential text presentation. It is a programming methodology that provides sophisticated relational activities in data sets. Hypergraph describes the design of a hypertext product. Hypermedia means a hypertext product that includes graphics, scanned pictures, sound, electronic files, video tape or video disk, and CD ROM. Appropriate interfaces may be necessary to be connected to PC for accessing video and CD ROM. LinkWay has all these capabilities. But our software uses only text and graphics.

A LinkWay file is called a folder. A folder consists of page. Each page is one screenful of information consisting of objects. There are three types of objects called buttons, pictures and fields. A button is

an action spot. A button may connect to another page, another folder, run a program or connect to another device. A picture object is a part of the page where a picture can be pasted from a picture file. A field consists of text.

Now let us develop a five question tutorial using linkway. We will develop one question in this workshop. We will provide you with one picture, several buttons for diagnosis and score collection, the instruction/prescription folder and the four remaining question folders and discuss the objects contained therein. (If you are a user of ERIC, you can get a disk by sending a blank formatted 3.5" disk to the following address. The disk contains the material distributed at the Conference. On the disk there is a subdirectory called sample that contains all the five problems. In order to develop the question 1 folder you will need IBM LinkWay. To run the program from the subdirectory you do not need any other program. Just type GO and press Enter key. Address: Dr. Umesh Nagarkatte, Medgar Evers College, 1650 Bedford Avenue, Brooklyn, NY 11225)

We will use the following problem.

Question 1) The local troop of Girl Scouts sells 200 boxes of cookies at $2.50 a box. If expenses were $350, how much profit did they make?

a $500 b $100 c $150

d $850 e None of the above.

We will use the following feedback for responses:

a You must subtract the expenses of $350 from the income to find the profit.

b Income = 200 x 2.50 = 500
Profit = Income - Expenses

c Great! You're right.

d You must subtract the expenses of $350 from the income of $500 to find the profit.

e Income = 200 x 2.50 = 500
Profit = Income - Expenses

hint 1: The income is 200 x 2.50.
Subtract the expenses from the income to find the profit.

hint 2: Income = 200 x 2.50 = $500
ref: Study Section 3.11 from Chapter 3 in the Textbook.

Please follow the steps given below.

1. Start LinkWay.

   i. Start your computer.
   ii. Type "cd lwwork" and press <Enter>.
   iii. Type "linkway /c" and press <Enter>.

   At this point the screen with Main menu and menu bar appears. Using the menu bar we will be able to perform all activities needed to develop the tutorial. The menu bar consists of five words which are the names of the five LinkWay menus. Each menu contains commands corresponding to its title. Click on a word. Check the pull down menu associated with the word. Click somewhere away from the menu and the menu disappears.

2. We are now ready to create a new folder. Let us call it "Queltut."

   i. Pull down the Folder menu and select New.
   ii. New Folder Name window appears.
   iii. Type QUE1TUT in the window and click outside to close the window.

   Now this folder has only one page - the Base Page. The base page is special because the objects placed on this can be used on all the pages of the folder. It is page 0.

   Now we will first select the background color for the folder. The present color is black. Let us change it to blue.

   i. Pull down the Option menu and select Bg Color.
   ii. Select New Background Yes from the dialog box.
   iii. Select No after the background becomes blue.

We now want to enter the first question. See Page 2 for the question.

To do this let us make a field to enter this question.

   i. Pull down the Object menu.

   ii. Select NEW.

   iii. The OBJECT TYPE window appears with three choices for objects. Click on Field. Click outside to close the window.

   iv. Move the cursor, which is now a small dotted box, to the left corner of the working area and click. This anchors one corner of the field.

   v. Drag the lower corner of the box by pressing the left button of the mouse and keeping it pressed and until the box is of the area about two thirds of the screen. Click the mouse. The dotted box shows the area we have for our text. Field Name window appears. We will not name this field. We close the window by clicking outside.

   vi. Font window appears. Choose the last font from the Font window and click outside to close the window. Field Information window appears. Close it by clicking without making any changes.

vii. Color window appears. The white dot shows the default color. Click on magenta. The color window is closed and the field or dotted box created in Step iv appears.

viii. Click twice in the field. The cursor becomes a bracket, [, and type in the given problem.

ix. Now draw white boxes around the letters A, B, C, D, E as follows:

Click on OPTION. Click on FG COLOR. Click on white color.

Click on PAGE. Click on BOX. Move the cursor, which is now a box, to a little left of A and above A and click once to anchor the corner of the box. Stretch the box to enclose A and click once again. Draw the same size boxes around B, C, D and E. If you want to erase a box click on PAGE and click on UNDO LAST and start over.

3. CREATING PICTURES :
In the right lower corner below the question, create a picture object of the size 2" x 3" using the following steps.

i. Click on OBJECT. Click on New.

ii. Object type window appears. Click on PICTURE. Click outside to close the window.

The cursor becomes a dotted rectangle. Move the cursor to the right lower part below the question in the empty area of the screen about 2.5 inches from the right edge and 3.5" from the lower edge of the question. Click once to anchor.

Stretch the rectangle to about 2.5" x 3.5". If you want to adjust the rectangle click on object and use move and size.

A name window appears. Name this picture "butons." and close the window.

iii. A window of picture files. From this menu highlight "Butons" and click once to select the picture. This picture was created using LWPAINT utility of LinkWay and stored on the disk earlier. Click outside the window to close it.

iv. The Adjust window appears on the left.

vi. In the adjust menu, click on fullpic. Click on right and down until the picture moves into the picture area created. Click outside to close the window. You might have to edit the picture to get it completely inside the picture object.

4. CREATING BUTTONS: Let us now create action for each button object on the base page.

i. Click on OBJECT.

ii. Click on NEW.

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iii. The OBJECT TYPE selection window appears. Click on Button and then close the window.

iv. Move the dotted rectangle to box around A. Stretch and cover a small area covering A. Be careful not to cover area near any other box.

v. The icon selection window appears next. Click on None.

vi. The BUTTON Name window appears. Click inside the parentheses in the window and enter a. Close the window by clicking outside.

vii. The BUTTON Type window appears. Click on Link. Link information window appears. The folder is the same. So just click once. Enter 1 for page.

viii. This button will open page 1 which will be created soon.

We will create all pages we need in the next step. Make similar buttons as follows:

```
B going to 2
C     to   3
D     to   4
E     to   5
hint1 to   6
hint2 to   7
ref   to   8
```

Now we will create new buttons for <-, ->, quit, help and autoexec.

To create button for -> :

i. Click on OBJECT. Click on New.

ii. In OBJECT Type window, click on Button.

iii. Place the rectangle on the left corner of -> box and drag the dotted rectangle to cover the box. Again, make sure you do not cover any other object. Finish the button by clicking.

iv. In the Button selection window, click on Link. Close the window. In the icon window select None and close the window.

v. In the Button Name window, click between the parentheses and enter NEXT. Close the window by clicking outside.

vi. In the Link information window, for folder type que2tut and for page type 0.

Que2tut is the folder that is created for you as the second question. 0 is the base page of that folder.

To create the button quit,
i.- iii. Follow the same steps upto iii as in the above. Name this button quit. No icon for this button.

iv. In the Link information window, for folder type insttut; and for page type 5. Close the window.

Insttut is the folder that contains instructions, data collection file, section reference, initialization, and report page. The report page is Page 5 of the instructions folder provided to you.

To create a button for help:

i. Click on OBJECT.

ii. Click on Button. Name this button help and choose no icon for this.button.

iii. Click on Script. A blank Script window appears.

iv. In the window, type in the following:

```
Prompt "Press F1 for instructions.";
Wait 5;
Prompt "Press <Esc> to clear instructions."
Wait 5;
Help 51;
```

Help 51 is a text file which was created using LWEdit which pops up when F1 key is pressed. The file, Help51, contains instructions on how to use the buttons and boxes created on the page.

v. Close the window.

To create an autoexec button for asking the user to make a choice.

i. Click on OBJECT.

ii. Click on Button. Name the button Autoexec. Do not choose any icon for this button.

iii. Click on Script in the Button Type window. Close the Button Type window. A blank Script window appears.

iv. In the window, type in the following:

```
Prompt "Make a choice.";
```

v. Close the window.

5. CREATING PAGES AND TYPING RESPONSES -

Now we will create new pages for creating feedback. We want one page each for A, B, C, D and E, Hint 1, Hint 2 and reference, in all eight new pages. Since there are only minor chages in the responses and hints we will not have to type everything. We will use the Cut and Paste Object feature of LinkWay.

Click on PAGE. Click on NEW. A screen with ID=1 on the STATUS LINE is displayed. On this page we will write the response to A.

In the area of the screen below the question we create a field.

i. Click on OBJECT. Click on New. In the object Type window Click on Field.

ii. Move the cursor to the left lower part of the screen just below the question. Anchor it by clicking once. Stretch the dotted rectangle so that the right edge is next to the buttons. Do not name this window.

iii. Select the lowermost font. Select Fg COLOR to Light blue.

Now move the cursor in the lower field and click twice so that the lower field appears with dotted rectangle and [cursor appears. Type the response to a. See Page 2 for the response.

Leave this field object highlighted. We will cut this object and paste it on other pages. Then we will make appropriate changes.

6. CUTTING AN OBJECT, PASTING ON NEW PAGES and EDITING:
To cut this object proceed as follows:

i. Click on OBJECT.

ii. Click on Cut.

iii. The Cut Object window appears. Replace Name of Cut "Scrap" by highlighting it and entering resp1. Close the window.

iv. The Cut completed window appears. Close the window.

Create Page 2. Follow steps for creating page 1 and field object described earlier.
In the field, type the response to choice B of the question.

After finishing the text, let us cut the object following the steps described for Page 1. Do not give it any name. It is named scrap by LinkWay.

Create Page 3. Follow steps for creating page 1 and field object.

PASTING AN OBJECT:

Create Page 4. On page 4 we paste the object we cut earlier as follows.

i. Click on OBJECT.

ii. Click on Paste. From the cut files window which appears next, click on Resp1.

iii. Paste the object on the lower part of the page.

iv. Now use the following directions to edit this field object and change the a to d since this is the response to choice d.

EDITING AN OBJECT:

To make minor changes in the pasted field object, click twice in the field. When the bracket cursor appears, use it to make changes, and click outside the field and close it. If you want to edit a button, the button should be on the page.

Create page 5, and on page 5, paste the object that is cut and named scrap following the above steps and edit.

Create page 6 and paste on this page the object named as resp1. Make appropriate changes in the text.

Create page 7 and paste on page 7 the object named scrap. Make appropriate changes in the text.

Create page 8, and create a field object and place it on the lower empty part of the page and click on it and enter the text for reference.

Only thing that remains to be done is to create the diagnostic button.

CREATING DIAGNOSTIC and EVALUATION BUTTONS: For each right or wrong response, we must have a button that automatically keeps track of student's performance. Instead of creating a button, let us paste a button called wrong on the page which is a wrong response and a button called right on the page of right response. We follow the steps given under Pasting an Object. Paste the button anywhere on the page. To edit this button 1) click on Object and click on Edit. The source code appears. Change the statement Donexx to Done1 and make other appropriate changes.

Each of these buttons is an "AUTOEXEC" button. As soon as this page appears the button starts its action.

Click on the button we pasted. This button is called script button. In a pop-up window the script program appears. Check whether the question number and the reference is correct. For each question, this information has to be updated. We have updated the information for other questions in the folder.

FINISHING THE TUTORIAL

A. Before saving the question folder we just created, we need to remove the menu bar and the status line. We need to change its access level from FORMAT to READ. We achieve this as follows.

   i. Click on OPTIONS. In the option menu, click on Menu Bar. The menu bar disappears. Similarly click on Status in the OPTIONS menu. The status line disappears.

   ii. Click on FOLDER. Click on Access.

   iii. Click on Read. Close the window.

   iv. Leave Password blank for now and close the window.

   v. In format level you have to click twice on any button to activate it. While at any other level clicking once is enough.

vi. Click on folder.

vii. Click on Save.

B. We need to have information from the instruction folder, so that you can change it to suit your needs. The steps to do this are:

i. Click on FOLDER. Click on Open.

ii. The folder file window appears. Click on Insttut.

iii. The insttut folder appears. Click on FOLDER. Click on Access. There is no password. Just click. In Access Level window, click on format.

iv. Click on GOTO. Click on next.

v. Press tab until autoexec button is highlighted.

vi. Click on OBJECT. Click on Edit. Click several times until a pop-up window appears.

vii. In the pop-up window, the script program is written. Click outside the window to close it. This program and all other programs are included in the handout.

viii. Press tab several times until a button in the right side of the page called init is highlighted.

ix. Click on OBJECT. Click on Edit.

x. Click several times until the pop-up window with the program appears. Here you can change the references of sections in the text book.

xi. Change the access level to READ.

C. Now we are ready to test our tutorial.

i. Open folder named MENUTUT.

ii. Now keep clicking and taking the test.

D. Preparing runtime version:

i. Copy all files from the subdirectory LWWORK. We have stored all the files needed to make a runtime version in the subdirectory LWWORK. (ERIC Users should refer to the manual of LinkWay for preparing a runtime version.)

iii. Type in GO and press <Enter> to start the runtime version.

------ The End -------